A GEOGRAPHIC INFORMATION SYSTEM WEB-MAPPING APPROACH FOR IDENTIFYING SPECIES AND LOCATIONS FOR ECOLOGICAL RISK ASSESSMENTS

T. Pfleeger
U.S. EPA NHEERL-WED
200 SW 35th Street
Corvallis, OR 97333
pfleeger.thomas@epa.gov
(541)754-4674

C. Burdick
U.S. EPA NHEERL-WED
200 SW 35th Street
Corvallis, OR 97333

J. Gabriel
Alsea Geospatial
450 SW Madison Ave
Corvallis, OR 97333

L. Ladd
Alsea Geospatial
450 SW Madison Ave
Corvallis, OR 97333

R. Schwindt
Alsea Geospatial
450 SW Madison Ave
Corvallis, OR 97333

J. Kern
Dynamac Corporation
200 SW 35th Street
Corvallis, OR 97333

ABSTRACT

In many countries, numerous tests are required prior to pesticide registration for the protection of human health and the environment from the unintended effects of pesticides. Currently, plant testing in the United States requires the use of ten species, selected because they are familiar to scientists, have an extensive history in a variety of experiments, and are easily managed. There is little evidence to suggest the ten species currently used are the most sensitive species to all toxicants; therefore, these species may not be indicative of the effects that could occur from exposure. Because of the limited scope of the current testing protocol, the uncertainty surrounding the data compels decision-makers to make more restrictive choices concerning the level of ecological risk. To address this problem, we have developed a more realistic approach using a Geographic Information System (GIS) that allows identification of species most likely to be exposed during chemical application. The GIS system developed for the contermi- nous United States uses crop location, crop diversity, pesticide use rates, and wind speed to de- termine high-risk areas. These factors can then be used to deter- mine relevant counties within the U.S. at risk for various exposure scenarios. The Census of Agricul- ture (USDA) was used to deter- mine the percentage of land in each county in agriculture by spe- cies and acreage. Pesticide appli- cation rates were determined from the National Center for Food and Agricultural Policy Pesticide Use Database. Wind data came from the USDA Ventilation Cli- mate Information System. Crops, non-cultivated plants, and threatened/endangered species are then identified for risk areas using the GIS. Threatened and endan- gered species data was obtained from the U.S. Environmental Protection Agency (U.S. EPA)/Office of Pesticide Programs. Results should decrease the uncertainty associated with ecological risk assessment due to pesticide exposure. The Web site has been available to the U.S. EPA since April 2004 and eventu- ally will be available to the public.
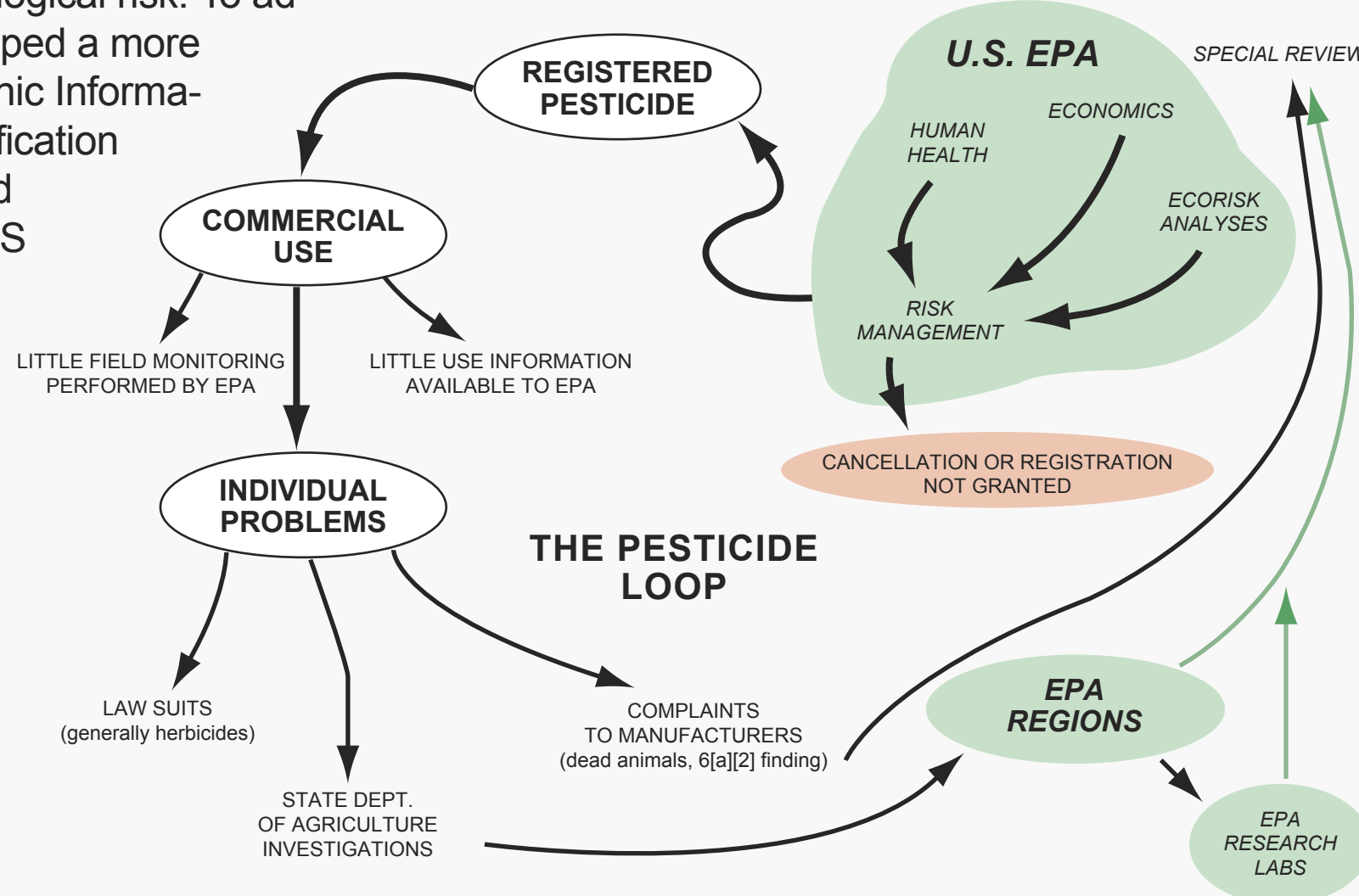
The Pesticide Loop – The pathway a pesticide travels during its regulatory lifetime. EPA has the most control of a pesticide during the registration process. Once registered, there is little if any field monitoring done and incident data are not generally reported directly back to EPA.

OBJECTIVE

To develop a method to identify species and locations at risk from pesticides and other chemicals released into the environment.

APPROACH

- Risks vary across the country based on climate, biology, and agricultural use patterns.
- Areas at highest risk can be identified using Geographical Information Systems (GIS).
- At risk areas identified can be queried using GIS to identify biological resources at risk.
- Biological resources at risk can be tested.

Conceptual drawing of how the GIS identifies areas at risk from the off-target movement of pesticides. Each data layer has been filtered through the one above it. The bottom map indicates counties with a high percent of land in agriculture, high use of herbicides, high crop diversity, and windy days during the growing season.
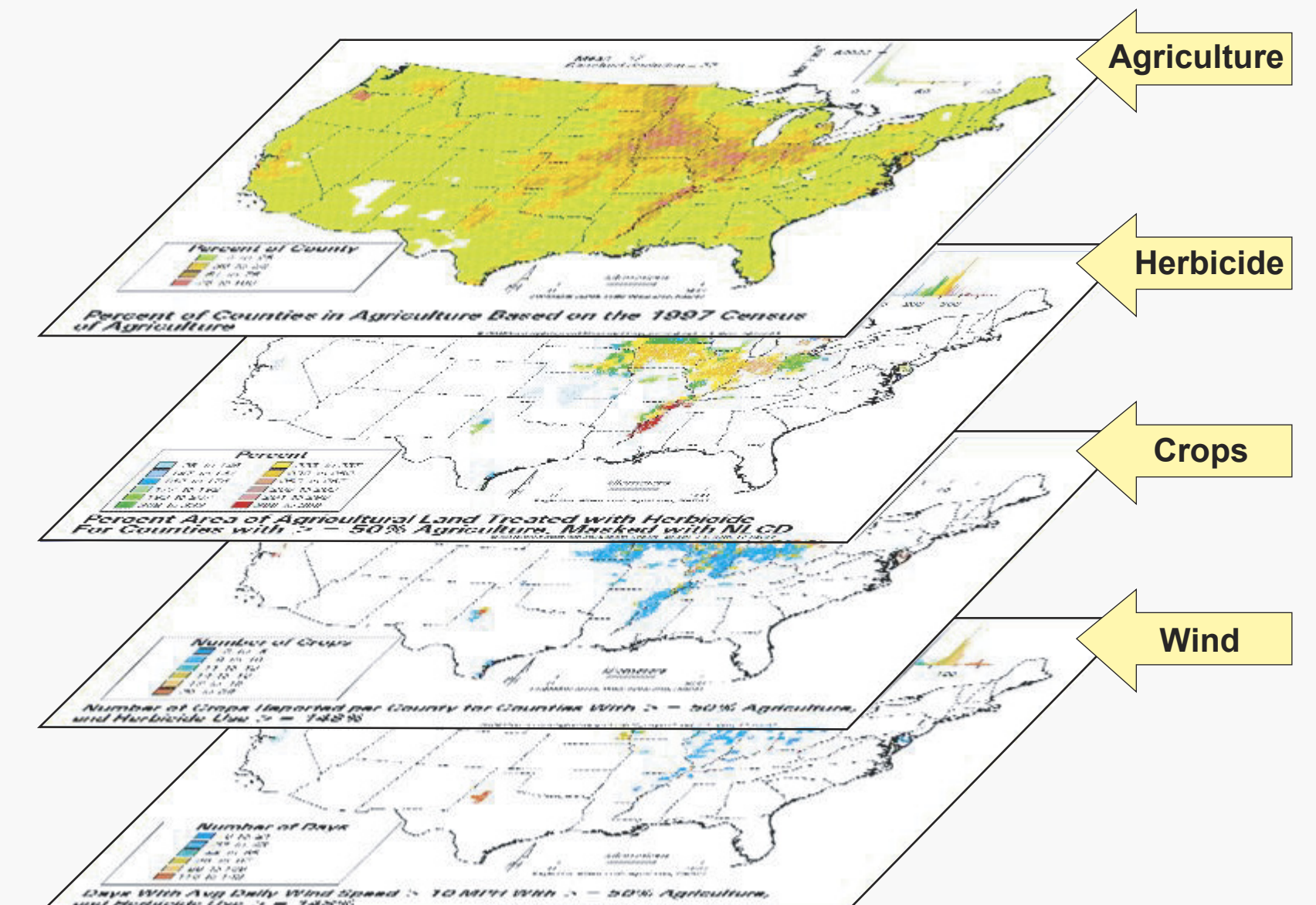
WEB-BASED MAPS AND DATA

WEDPest – http://wedpest.cor.epa.gov

Web Page Layout for U.S. EPA Pesticide Query

The web page contains three frames. The first, on the left, contains the map viewer used to display the geography of selected attributes. Tools at the bottom of the maps viewer are used to zoom in, zoom out, pan, print, select, and retrieve information about the counties. The center green frame contains map layers and the legend. The right frame holds the query tool. Queries search for counties that meet selected criteria. For example, counties in Illinois where corn is grown and where pesticide 2,4-D is applied.

Data and Software Utilized on Web Page

The minimum mapping unit is a county and all database tables are linked to the counties by a unique number. For example, we can identify pesticide use by county but not the specific fields where they are applied. Or, we can identify endangered species by county but not their specific locations within the county.

- 3109 U.S. counties (lower 48 states)
- 19 GIS layers/database tables
- Linked to county shapefile

The web mapping site is powered by ArcIMS 4.0.1 customized using Java Script, MS Access as the database, and custom C# code for the query tool.

CONCLUSIONS

1) The GIS identifies areas, crop plants, and threatened and endangered species at risk.

2) The system is limited by available data and the quality of the data (i.e., no nationwide pesticide data on forests or for forestry uses).

3) The system works as an EPA intranet web site that can be queried.

4) The system is easy to use by non-GIS personnel.

5) Additional databases can be added.

FUTURE PLANS

1) The EPA intranet web site is now being tested.

2) Additional data bases are being sought.
   - Native plants of North America
   - Wildlife, especially birds
   - Wind direction
   - Watersheds

3) Available to the public in less than two years.

epascienceforum
Collaborative Science for Environmental Solutions

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

2005
epa.gov/scienceforum